

Translation

PATENT COOPERATION TREATY

PCT/FR2003/002026



PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference B 14196.3 PV	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FR2003/002026	International filing date (day/month/year) 30 juin 2003 (30.06.2003)	Priority date (day/month/year) 02 juillet 2002 (02.07.2002)
International Patent Classification (IPC) or national classification and IPC A61N 5/10, G21K 1/093, 5/04		
Applicant COMMISSARIAT A L'ENERGIE ATOMIQUE		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of <u>5</u> sheets, including this cover sheet.  <input checked="" type="checkbox"/> This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).  These annexes consist of a total of <u>3</u> sheets.
3. This report contains indications relating to the following items:  I <input checked="" type="checkbox"/> Basis of the report II <input type="checkbox"/> Priority III <input type="checkbox"/> Non-establishment of opinion with regard to novelty, inventive step and industrial applicability IV <input type="checkbox"/> Lack of unity of invention V <input checked="" type="checkbox"/> Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement VI <input type="checkbox"/> Certain documents cited VII <input type="checkbox"/> Certain defects in the international application VIII <input type="checkbox"/> Certain observations on the international application

Date of submission of the demand 19 janvier 2004 (19.01.2004)	Date of completion of this report 15 September 2004 (15.09.2004)
Name and mailing address of the IPEA/EP  Facsimile No.	Authorized officer  Telephone No.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FR2003/002026

## I. Basis of the report

## 1. With regard to the elements of the international application:\*

- ☐ the international application as originally filed
- ☒ the description:  
pages \_\_\_\_\_ 1-26 \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☒ the claims:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, as amended (together with any statement under Article 19  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_ 1-10 \_\_\_\_\_, filed with the letter of \_\_\_\_\_ 21 June 2004 (21.06.2004)
- ☒ the drawings:  
pages \_\_\_\_\_ 1/3-3/3 \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_
- ☐ the sequence listing part of the description:  
pages \_\_\_\_\_, as originally filed  
pages \_\_\_\_\_, filed with the demand  
pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_

## 2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language \_\_\_\_\_ which is:

- ☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of the translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

## 3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☐ The amendments have resulted in the cancellation of:

- ☐ the description, pages \_\_\_\_\_
- ☐ the claims, Nos. \_\_\_\_\_
- ☐ the drawings, sheets/fig \_\_\_\_\_

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).\*\*

\* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rule 70.16 and 70.17).

\*\* Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FR 03/02026

**V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement****1. Statement**

Novelty (N)	Claims	1-10	YES
	Claims		NO
Inventive step (IS)	Claims	1-10	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-10	YES
	Claims		NO

**2. Citations and explanations****1. Reference is made to the following documents:**

D3: US-A-4 962 317 (JASON ANDREW J ET AL)

9 October 1990 (1990-10-09)

D4: WO 00/40064 A (JONGEN YVES; ION BEAM APPLIC

(BE)) 6 July 2000 (2000-07-06)

2. D3, which is considered the closest prior art, describes a device for irradiating a target with a charged hadron beam (column 1; line 25) that is produced by means for generating a charged hadron beam. The device comprises corpuscular optical means adapted to render the transverse density of the charged hadron beam uniform (figure 1, reference sign 14) in at least one direction perpendicular to the path of the charged hadron beam (see column 4, lines 1 to 8).

The device further comprises scanning means suitable for moving the charged hadron beam such that it scans the target "along" (see point 4.1 below) a narrow, substantially rectangular, strip (see column 4, lines 9 to 23).

The device according to D3 differs from the device to which claim 1 relates by virtue of

- i) means for controlling the irradiation of the target by the charged hadron beam in three dimensions, these means comprising devices for regulating the energy of the charged hadrons produced, and
- ii) scanning means adapted to "*follow a median line in the centre of the narrow strip*" (see point 4.3 below), whilst lengthening or shortening this narrow strip so as to follow the target contours.

Therefore the subject matter of claim 1 is novel (PCT Article 33(2)).

As concerns feature i):

The problem addressed by feature i) can be considered to be that of improving conformational irradiation. D4 proposes varying the beam energy so that scanning can be carried out in three dimensions (see page 8, lines 22 to 33) in order to make the irradiation conform with the target volume. Therefore the inclusion of feature i) in the device described in D3 is a routine measure for a person skilled in the art attempting to solve the problem of interest.

As concerns feature ii):

The problem addressed by the present invention can be considered that of improving conformational irradiation. Feature ii) does not appear in the prior art and cannot obviously be derived therefrom.

In spite of the lack of clarity mentioned below, the solution to the problem proposed in claim 1 of the present application is considered to involve an inventive step (PCT Article 33(3)).

3. Claims 2 to 10 are dependent on claim 1 and thus likewise meet the PCT novelty and inventive step requirements.

4. Further observations:

The application does not meet the requirements of PCT Article 6 since claim 1 is unclear.

- 4.1 The target is scanned **in** rectangles (see page 22, line 25, page 25, lines 17 to 19, and page 19, lines 15 to 22, of the present application); therefore scanning is carried out **in** narrow strips, not **along** a narrow strip.
- 4.2 It is not clear from claim 1 that the cross-section of the beam which is made uniform **actually forms this narrow strip** (see page 17, lines 26 to 31, and page 16, lines 4 to 10, of the application).
- 4.3 The scanning means do not follow a median line in the centre of the narrow strip; rather, it is the **centre of gravity of this narrow strip which follows a median line of the target** (see page 19, lines 5 to 8, of the description).

**THE FOLLOWING ARE THE ENGLISH TRANSLATION  
OF ANNEXES TO THE INTERNATIONAL PRELIMINARY  
EXAMINATION REPORT (ARTICLE 34):**

**Amended Sheets (Pages 25-27)**

CLAIMS

1. Irradiation device for a target (12), particularly an area of the human body, by a charged hadron beam (4), this beam being produced by means of generating a charged hadron beam, this device being  
5 characterized by the fact that it comprises:

- corpuscular optics means (14, 16, 18, 20), designed to make the transverse density of the charged hadron beam uniform, along at least one direction perpendicular to the trajectory of  
10 this charged hadron beam, and
- means (6, 22, 24; 10, 22, 24) for the three-dimensional control of the irradiation of the target by this charged hadron beam.

15 2. Device according to claim 1, in which the corpuscular optics means comprise at least one non-linear corpuscular optics lens.

20 3. Device according to claim 1, in which the corpuscular optics means include two non-linear corpuscular optics lenses designed to make the transverse density of the charged hadron beam uniform, along two directions perpendicular to each other and to the trajectory of this charged hadron beam.

25 4. Device according to either claim 2 or 3, in which each non-linear corpuscular optics lens is  $2n$ -polar, where  $2n$  is an integer equal to at least 8.

REPLACED BY  
ART 34 AND 1

5. Device according to any one of claims 1 to 4, in which the three-dimensional control means include:

- means of adjusting the energy of the generated charged hadrons and
- 5 - scanning means capable of displacing the charged hadron beam to make it scan the target along a narrow substantially rectangular band.

6. Device according to claim 5, in which the  
10 scanning means include a pair of magnetic dipoles.

7. Device according to either claim 5 or 6, in which the charged hadron beam generation means comprise a synchrotron and the means for adjusting the energy of  
15 the generated charged hadrons are the means of adjusting the energy of the charged hadrons produced by this synchrotron.

8. Device according to either claim 5 or 6, in  
20 which the means of generation of the charged hadron beam comprise a cyclotron and the means of adjusting the energy of the generated charged hadrons include moment analysis means.

25 9. Device according to any one of claims 5 to 8, in which the scanning means are capable of causing the centre of the narrow band to follow a median line while lengthening or shortening this narrow band in order to follow the contours of the target.

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REPLACED BY  
ART 34 AMDT



10. Device according to any one of claims 5 to 9,  
in which the corpuscular optics means are capable of  
varying the uniformisation of the transverse density of  
the charged hadron beam depending on the length and /  
5 or the width of the narrow band.

11. Device according to any one of claims 1 to  
10, in which the scanning means are capable of making  
the charged hadron beam scan the target at  
10 predetermined depths of this target, a plurality of  
times for each of these depths, the dose delivered to  
the target each time being equal to the total dose  
required for this depth, divided by the number of  
times.

15

12. Device according to any one of claims 1 to  
11, in which the charged hadrons are light nuclei.

REPLACED BY  
ART 34 AMDT